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DESIGN, IMPLEMENTATION, AND EVALUATION OF AN INSTRUMENTAL AND METHODOLOGICAL PLATFORM FOR TEACHERS' PROFESSIONAL COMPETENCY DEVELOPMENT

Abstract. The rapid digital transformation of education requires new approaches to supporting teachers' professional development and strengthening their ICT competencies. This study aimed to design, implement, and evaluate an instrumental and methodological platform intended to provide comprehensive methodological support for teachers in secondary education. The platform integrates regulatory documentation, teaching resources, professional development planning, webinars, coaching, collaborative communication, competency monitoring, and analytical feedback within a unified digital environment. A quasi-experimental research design was employed involving 160 teachers of Geography and Computer Science from public secondary schools in Astana, Kazakhstan. Participants were divided into an experimental group (n = 80) and a control group (n = 80). Professional competencies were assessed using psychological-pedagogical diagnostics, questionnaires, observations, expert evaluation, and statistical analysis based on Fisher's angular transformation criterion. The findings demonstrated that teachers using the proposed platform achieved higher levels of ICT competence, communication skills, professional motivation, and creative engagement than those in the control group. The comparison between the experimental and control groups revealed statistically significant differences ($\varphi^* = 2.41$, $p = 0.016$), confirming the effectiveness of the platform. The integrated digital environment also facilitated continuous methodological support, improved collaboration among teachers, and enhanced opportunities for individualized professional development. The study concludes that the proposed instrumental and methodological platform represents an effective solution for developing teachers' professional competencies in the context of digital education. The findings contribute to the modernization of teacher professional development systems and may serve as a practical framework for educational institutions implementing digital transformation strategies.

Keywords: Instrumental and methodological platform, support, educational organizations, ICT, competencies.

Introduction

Teachers should be ready to use new technologies in the educational environment (Zulpykhar et al., 2025) to ensure effective learning and development of students. In the process of modernization of education related to the development of information and communication technologies, new opportunities for the educational process are opening up. Teachers should apply the skills and competencies that become necessary in the conditions of the informatization of society and education (Baydjanov, 2021). The authors describe several skills and competencies that teachers should possess:

1. Digital literacy: the ability to effectively use information and communication technologies to search, evaluate, analyze, and process information.
2. Computer thinking: ability to formulate and solve problems using concepts and methods of computer science.
3. Information security: awareness of possible threats to information security and the ability to protect your information.
4. Critical thinking: the ability to analyze information, evaluate its reliability, and make informed decisions.
5. Communication skills: the ability to communicate and collaborate effectively in virtual environments (Mukasheva et al., 2023).

6. Creativity and innovation: the ability to generate new ideas, develop innovative solutions, and find non-standard approaches to solving problems.

7. Self-organization and self-motivation: the ability to plan your activities, work independently, and motivate yourself to achieve your goals (Zulpykhar & Azamat, 2025).

This will help make the learning process more interactive, accessible, and effective (Karelkhan et al., 2024). Teachers with ICT skills can effectively use online resources for self-education and professional development. They can study new teaching methods, get access to up-to-date scientific and methodological literature and lectures, and exchange experiences with colleagues around the world.

Thus, teachers who can apply the new didactic potential of ICT are in demand in the modern information society as specialists who can effectively use modern technologies for the education and development of students. At the same time, despite the indisputable importance of the conducted research, the problem of using modern means of informatization for teacher training, in particular, for the formation of their ICT competence, has not yet been completely solved. One of the main reasons for this problem is the lack of time and resources to master the necessary skills in the field of information technology (Seitakhmetova et al., 2022). To solve this problem, it is necessary to provide teachers with access to modern means of informatization and create special educational programs that would help them master the necessary skills. In addition, it is important to change the approach to teacher training by including mandatory courses in information technology (Kopeyev et al., 2020) in the curriculum.

The analysis of scientific and pedagogical research and the current situation in the practice of the formation of professional competence of teachers through an instrumental and methodological platform allows us to identify the following contradictions:

1. Despite the proliferation of educational platforms, access to them and the quality of equipment may vary significantly in different regions and educational institutions. This creates an inequality in the ability of teachers to develop their professional skills.

2. Teachers have limited working hours and may face difficulties in finding time to learn new pedagogical approaches and methods. This may reduce their motivation and opportunities for professional development.

3. Teachers may feel apprehension and resistance before introducing new technologies into the educational process, especially if they do not have sufficient support and feedback. The purpose of methodological support is the systematic creation of organizational, educational, technical, and informational conditions for systematic self-development. The development of an integrated system of methodological support should be based on the principles of scientific character, predictability, flexibility, mobility, and continuity. Taking into account these principles, the process of teacher development becomes an interaction of a creative laboratory of joint searches and the introduction of educational innovations into the system of pedagogical activity.

Among the functions of methodological support for the pedagogical development of teachers, we define the following: educational, advisory, service, coaching, adaptation, expert, moderation, corrective-reflexive, and others.

Methods and means of organizing such activities can be used: modern learning technologies, including information and communication technologies, distance learning, games, dialogue, focus groups, tutoring, team building, and others. These methods must include a basis for reflection as a necessary element and as an indicator of the quality of interaction in the system of continuous pedagogical development.

In addition, forms of methodological support for teachers include:

organizational methods of support (consultations, coaching, assistance in the work of creative teams, school-wide seminars, pedagogical council). This is the essence of information transmission, they are divided into active (discussions, business games, training, etc.) and passive (speeches at pedagogical councils, meetings; questionnaires (other forms of public opinion polls); acquaintance with printed information (books, textbooks), etc.);

the creation of organizational (resource room or work information center) and methodological (consulting) conditions for teachers' participation in various events: courses, conferences, methodological associations, round tables, seminars, workshops, etc.;

providing methodological support (mentoring) for teachers conducting research activities and pedagogical experiments;

Provide information support to teachers to participate in various training events (conferences, master classes, professional skill competitions) to present and summarize their experience.

Therefore, we believe that the organization and methodological support of pedagogical activities are indispensable, systematically organized activities create conditions for the professional growth of teachers and the development of professional and pedagogical abilities of teachers in this process.

The dictionary definition of the concept of "escort" presents its content as "following along with someone, being nearby, leading somewhere or following someone; to accompany, accompany, go."

The founder of the idea of pedagogical support was Gazman (2018), who identified a special direction in the theory and practice of education – "pedagogy of self-awareness", according to which pedagogical activity was considered to stimulate the processes of independence in the pupil with the help and support of the teacher.

By analyzing the scientific literature, it is possible to assess the need to support teachers in general education organizations based on an integrated and differentiated approach. These methods include the following (Abylkassymova et al., 2020): to provide an opportunity to adapt the educational and methodological space of the school to the personality and interests of the teacher; to give them freedom of choice and change in the context of educational institutions; to form a desire for self-education and self-improvement, to solve individual problems of personal development in connection with the needs of society in the context of modernization of the education system.

To generalize the experience, pedagogical events are organized in Astana, scientific and practical conferences, seminars, methodological landings, round tables for secondary education organizations and preschool educational institutions, methodological days of practical training, and master classes are held.

Methodological support is understood as helping the teacher in the formation of the orientation field of professional self-development, and responsibility for the actions for which he is responsible (Salmon, 2012).

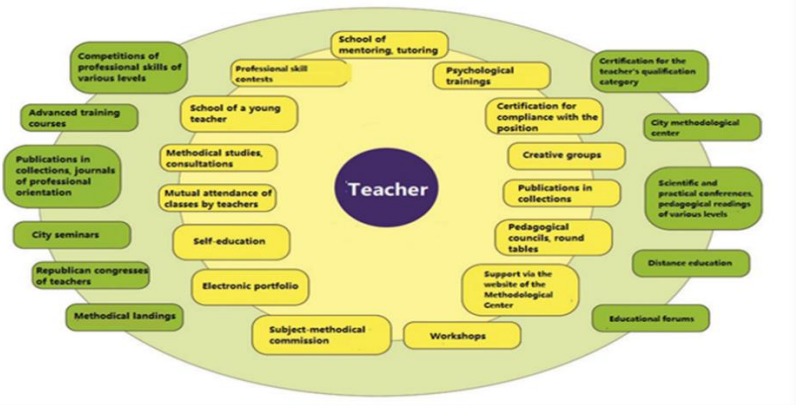
We consider the organization and methodological support of pedagogical activity in general and systematically organized activities, which creates conditions for the professional development of teachers, the development of the pedagogical profession, and pedagogical abilities. As a management technique for organizing the interaction of academic disciplines (Higueras-Rodríguez et al., 2020).

So, let's consider the implemented model of organizational and methodological support of teaching staff in Astana.

Figure 1 describes a model of methodological support for teachers of Astana city (hybrid, personalized), which provides for the individualization of methodological support, that is, provides a positive position for teachers, since in the practice of working with teaching staff this is a traditional mode. Individualized transition of the professional development system.

Figure 1

A model of instrumental and methodological support of teaching staff in the city of Astana has been developed



This model combines forms of online support and offline methods, which are mixed, since resource management is carried out through an instrumental and methodological platform developed by the authors of the study. The main content of the resources is implemented to provide advice to teachers, conduct practical psychological and pedagogical seminars, trainings, webinars, round tables and master classes.

Unlike general-purpose learning management systems such as Moodle, Google Classroom, or Microsoft Teams, the proposed instrumental and methodological platform was specifically designed to support teachers' professional development rather than student learning. The platform integrates regulatory documentation, methodological resources, professional development planning, webinar management, coaching activities, collaborative communication, monitoring of competency development, and analytical feedback within a single environment. This integrated approach enables continuous methodological support throughout teachers' professional activities and reduces fragmentation caused by the use of multiple independent digital services.

The scientific novelty of the study lies in the development and implementation of new methodological tools, techniques, and technologies aimed at improving the quality of education. These tools expand the possibilities for organizing teachers' professional development and provide more structured support for the formation of their ICT competencies.

Another important aspect of the study is the transition to digital resources hosted on an instrumental and methodological platform. Within the framework of methodological support for teachers' activities, this platform serves as a unified environment for accessing educational materials, methodological recommendations, and digital tools necessary for professional growth.

In addition, the study ensures the combination of online and offline forms of methodological support. This approach was implemented in the context of the priority national project "Quality Education: Educated Nation" and allows for a more flexible, accessible, and practice-oriented system of professional support for teachers.

Research methods and organization

The purpose of the experimental work is to evaluate the effectiveness of the implementation of an instrumental and methodological platform for accompanying teachers in the development of the discipline "Geography" and "Computer Science". The study involved 160 teachers from public secondary schools in Astana, Kazakhstan. Participants included teachers of Geography and Computer Science. Their teaching experience ranged from 3 to 25 years. Teachers voluntarily participated in the study and provided informed consent. The sample included 80 teachers assigned to the experimental group and 80 teachers assigned to the control group. The authors analyze how the instrumental and methodological platform can be used taking into account the specifics of subjects, curricula, and a group of teachers. Teachers were assigned to the experimental and control groups according to comparable characteristics, including teaching experience, subject specialization, and initial ICT competency level. Baseline testing confirmed that no statistically significant differences existed between the two groups before the intervention ($p > 0.05$).

Approaches to using the platform may vary depending on the subjects, as each subject has its own specific requirements and learning objectives. In many cases, teachers require methodological support and training to effectively use new knowledge and skills in their practice. When choosing teaching methods using an instrumental and methodological platform, it is important to take into account their convenience and effectiveness for specific groups of teachers and their ability to successfully integrate these technologies into the educational process (Zhang et al., 2022). Salmon (2012) points out that platforms can significantly strengthen and improve methodological support in learning by providing students with access to extensive information, interactive resources, and learning tools. They emphasize that methodological support using the educational platform makes it possible to diversify educational materials, attract students to active participation, and stimulate their academic achievements. Higueras-Rodríguez et al. (2020) speak about the importance of methodological support with the use of an instrumental and methodological platform in the context of teaching teachers. He points to the potential of the platform that helps teachers develop their professional skills and improve the quality of education. Dessart L. et al., considers methodological support using the online platform in the context of the development of media education. He notes that the instrumental and methodological platforms allow students to actively interact with a variety of media resources (for example, video, audio, and graphics) and develop critical thinking, communication skills, and the ability to cooperate.

The implementation of the concept of pedagogical effectiveness on methodological support with the use of an instrumental and methodological platform for teachers was carried out in a contingent of organized groups. Experimental work was carried out to assess the effectiveness and usability of the platform for methodological support of teachers. Within the framework of this concept, teachers received support and support in using the instrumental and methodological platform in their teaching activities. Special webinars, seminars, and training were developed and conducted, which helped teachers to master new technologies and effectively apply them in the educational process. Organized groups of teachers started using the educational platform in their pedagogical practice, which allowed them to significantly improve the quality of education and make the learning process more interesting and accessible to students. New methodological materials, lessons, and programs adapted for teachers were developed and implemented. Teachers actively used computer programs, multimedia presentations, interactive whiteboards, and other ICT tools in their work. This allowed teachers to make the learning process more visual, interactive, and accessible to all students. The results of the implementation of the concept of pedagogical efficiency using the instrumental and methodological platform were positive . Teachers have become more confident and motivated in their work, which has led to an improvement in their professional skills and student learning outcomes. Students have become more active and interested in the learning process thanks to the introduction of new technologies.

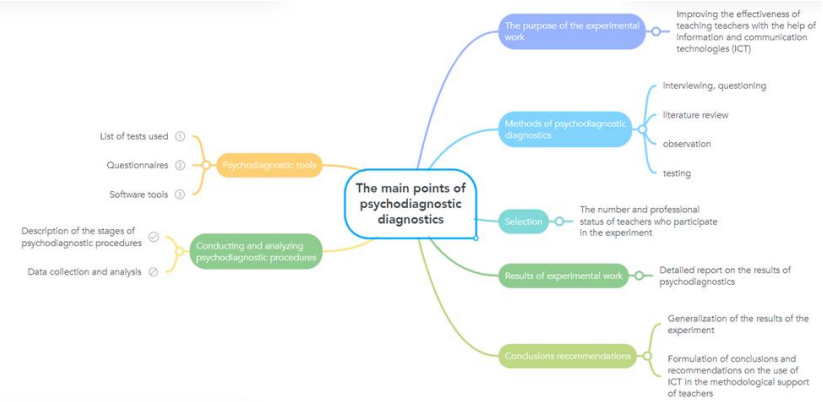
The purpose of this study is to assess the professional competence of teachers using a diagnostic complex that includes quantitative and qualitative assessment methods. The diagnostic procedure is designed to identify the level of knowledge, skills, and abilities of teachers in the professional field. The quantitative assessment is based on the calculation and analysis of quantitative data, such as the number of correct answers to test tasks, the time spent on completing tasks, etc. This makes it possible to determine the numerical indicator of the professional competence of teachers. Qualitative assessment includes an analysis of qualitative characteristics, such as the level of depth of understanding of the material, the ability to apply knowledge in practice, the flexibility of thinking, and a creative approach to problem-solving. These parameters are evaluated subjectively, with the help of expert evaluation or by analyzing the quality indicators of completed tasks.

Psychological and pedagogical diagnostics includes the following methodological tools:

- general scientific method: observation, interview;
- psychological and pedagogical method: questionnaires, tests, documentation analysis, analysis;
- products of students' activities;
- socio-psychological method: sociometry, rating;
- method of mathematical statistics: methods for assessing the reliability of the shift of values
- feature, cluster analysis methods (Figure 2).

Figure 2

The main points of psychodiagnostic diagnostics of experimental work on methodological support of teachers using an instrumental and methodological platform

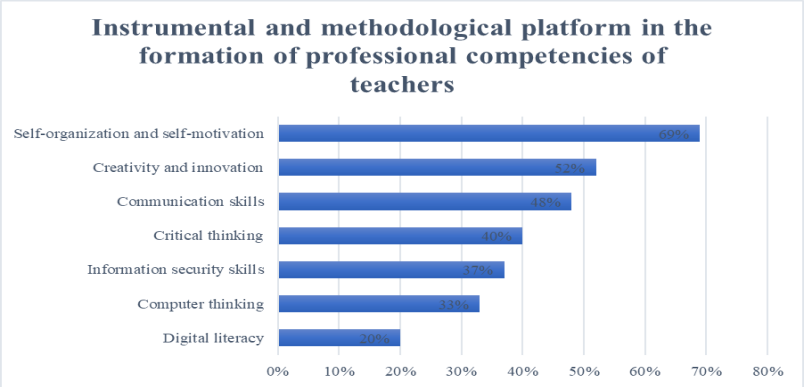


To select questions for teachers, a modification of the "professional competence" tests was used,

which allows for assessing the level of training and professional skills of teachers, as well as identifying their potential problem areas that require further training or development. The method aimed at a comprehensive assessment of these connections involves the use of various tools and tests to assess cognitive functions and activation processes. This may include tests on memory, attention, problem-solving, logical thinking, and other cognitive skills. It can also be used to measure reaction time, information processing speed, and other instrumental indicators. This method can help in making decisions about professional development opportunities, mentoring programs, and other resources that will help teachers improve their skills and knowledge.

Figure 3

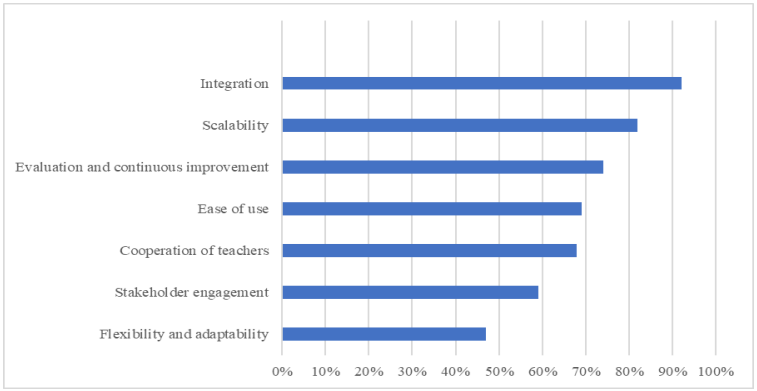
Instrumental and methodological platform in the formation of professional competencies of teachers



The most important knowledge and skills that are laid down when using the instrumental and methodological platform are identified, focused on the formation of such competencies as: "Digital literacy" 20%, "Computer thinking" 33%, "Information security" 37%, "Critical thinking" 40%, and 48% - "Communication skills", "Creativity and innovation" 52%, "Self-organization and self-motivation" 69% (Figure 3).

Figure 4

The basic principles of the formation and development of the instrumental and methodological platform



The basic indicators of the components were confirmed by the professional levels determined between the control and experimental groups using an instrumental and methodological platform. During the implementation of this platform, statistical tests of data were carried out, which were used together with the multifunctional Fisher angle transformation criterion (φ* Fisher criterion). This was done in order to confirm the homogeneity of the data, which is expressed in the lack of significant differences in the sample groups of KG (control group) and EG (experimental group) (Figure 4).

The results of the study and discussion

When discussing the formation of ICT competence of teachers, it is proposed to consider the following

components: motivational-target, organizational-content, procedural-technological and evaluative-reflexive. This helps the teacher to develop the skills necessary for the effective use of ICT in the educational process (Figure 5).

Figure 5

Comparison of the structural component of ICT competence at the stages of the formation of disciplines, ccording to the instrumental and methodological platform

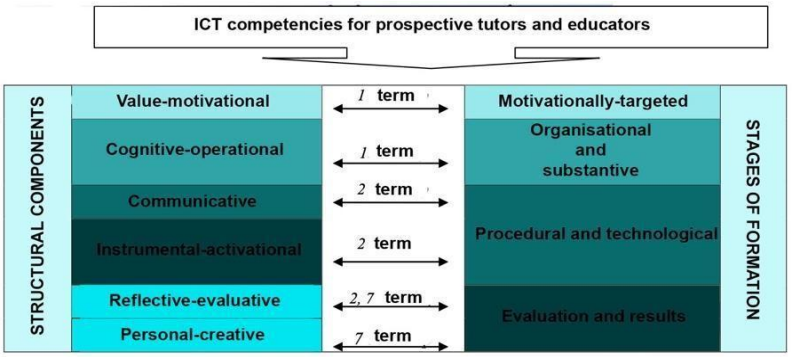


Table 1

Criteria for the formation of structural components of ICT competence in teachers

Structural component	Criteria of formation
1. Value-motivational	1. Understanding the importance of using ICT, using IMP (instrumental and methodological platform), in professional activities; 2. Motivation to carry out professional activities using ICT; 3. Network etiquette, and personal data protection in IMP.
2. Cognitive-operational	1. Understanding the essence and meaning of information; 2. Viewing, searching, and filtering data, information, and educational content for the creation and development of IMP; 3. Evaluation of data, information, and content and their management using the IMP.
3. Communicative	1. Interaction with the use of ICT in EE (information and educational environment); 2. Exchange of ICT tools and mediation in the field of EE; 3. Cooperation with the use of ICT, including IMP, in EE.
4. Instrumental-activation	1. Development of educational content using IMP; 2. Development of IMP; 3. Integration and revision of educational content using IMP.
5. Reflexive-evaluative	1. Development and evaluation of individual progress, IEM (informational and educational materials) with the help of IMP; 2. Assessment of the feasibility of using ICT; 3. Assessment of methodological support of teachers.
6. Personal-creative	1. Creative use of ICT in professional activity; 2. Identification of individual needs, and creative use of technologies with the help of IMP; 3. Identification of the lack of competence in the field of ICT.

The results were analyzed in the control and experimental groups during the period from 2021 to 2024. To do this, various methodological approaches and an instrumental and methodological platform were used. In the process of analyzing the results, the data obtained from the control and experimental groups were compared. The results of the analysis helped to understand the impact of the use of ICT on the educational process and to evaluate the effectiveness of the applied methodological approaches.

Table 2 presents the results of a study of the value-motivational components of ICT competence of teachers at the stage of EW formation (experimental work). Within the framework of diagnostics, the dominant motive of teachers' educational activity was determined.

Table 2

Criteria for the formation of structural components of ICT competence in teachers

Group	Communicative motives	Avoidance motives	Motives of prestige	Professional motives	Motives for creative fulfilment	Educational and cognitive motives	Social motives
CG1	45	69	52	39	45	42	38
CG2	45	68	53	40	46	44	39
CG3	46	67	54	40	48	44	39
CG4	48	69	55	42	49	42	40
EG1	55	60	50	52	57	50	54
EG2	58	55	51	54	56	52	55
EG3	62	50	51	55	57	56	57
EG4	78	50	50	62	65	59	64

According to the data given in Table 2, we can see the dynamics of changes in teachers' attitudes towards the learning process, taking into account the use of an instrumental and methodological platform, as well as personal and professional development. It should be noted that the dominant motive of avoiding failure, fixed at the ascertaining stage of EW, sharply decreased in all experimental and control groups. This fact may be due to the social adaptation of teachers in the educational environment of the school during the training period, including the use of IMP and other EIEE resources (Electronic Information and Educational Environment). The motives for the prestige of receiving a high assessment changed with the least dynamics in all groups participating in the EW, which may be due primarily to the professional orientation of teachers to the educational results of formal and significant achievements of non-formal education. In turn, there is a positive dynamics of educational and cognitive motives, interest in the study of the disciplines "Geography", and "Computer Science". Thus, the participants of the experimental groups EG1, EG2, EG3, and EG4, who studied these disciplines with the support of e-learning courses, webinars, seminars, round tables, forums, and coaching, noted these motives to a greater extent (for example, EG4 - 58% of respondents, and CG4 - only 41% of the respondents).

Among the most significant motives, according to the data obtained during the ER, it should be noted the motives associated with communication and interaction of teachers in the generalization and dissemination of pedagogical experience. Thus, among 77% of respondents of the EG4 group, it is defined as the most dominant, respectively, EG3 group - 61%, EG2 group - 57%, and EG1 group - 54%. In turn, among the control groups of students, the maximum indicator of this motive is recorded in CG4, and is only 47%.

The results of the study of the value-motivational component of the ICT competence of teachers allow us to note an increase in the importance of developing motivating factors among the experimental and control groups studied.

It should be noted that the category of tasks related to the assessment and analysis of information and the content of the IMP can be considered the most difficult for teachers to perform. This section of tasks presented in the electronic training course of the disciplines being developed shows the least dynamics of the formation of the cognitive-operational component of the ICT competence of teachers. This fact is primarily due to the multidimensionality and variability of the proposed tasks using the tools of the methodological platform in the e-learning course, which require not only additional operational knowledge about ICT but also the ability to use various resources in the educational process. This confirms the didactic potential of the instrumental and methodological platform for further use. In general, experimental groups of teachers demonstrated a higher success rate in solving problems in the subjects taught (71% for EG4, 69% for EG3, 65% for EG2, and 63% for EG1), which indicates increased functionality of the cognitive-operational component of ICT competence.The results of the evaluation of the instrumental activation component of the ICT competence of teachers at the formative stage of the experiment are shown in Table 3.

Table 3

Results of evaluation of the instrumental and motivational component of ICT competence of teachers at the formative stage of the experiment, %

Group	Understanding the nature and importance of educational content for the creation and development IMP	Review, search and analyse information, educational content for IMP creation and development	Evaluate, manage, analyse information and educational content through IMP	Average success %
CG1	37	45	40	41
CG2	38	45	41	41
CG3	40	46	43	43
CG4	42	48	45	45
EG1	65	66	60	64
EG2	70	67	60	66
EG3	73	70	67	70
EG4	75	72	69	72

The data presented in the table on the dynamics of the formation of the instrumental activation component of ICT competence of teachers confirm the overall positive dynamics of the success of the tasks proposed within the framework of the developed methodological support for disciplines among the experimental and control groups of teachers with a numerical predominance of the experimental group (74% of respondents in EG4 and only 42% of students in CG4). According to the diagnostic results, the average and above-average level of formation of the instrumental activation component in the studied groups was determined. It should be noted that the smallest number of respondents in the experimental and control groups demonstrated the ability to use IMP as an integrated tool aimed at the formation of ICT competencies (68% of respondents in EG4, 44% of students in CG4). First of all, this confirms the prospects of IMP and practical developments in the field of using IMP as an effective means of forming ICT competence in teaching teachers in the conditions of informatization of education and requires further study.

In general, the experimental groups of teachers compared with the control groups showed a higher average success rate of tasks (73% - EG4, 70% - EG3, 68% - EG2, 67% - % - EG1), which confirms the increased level of instrumental functionality of the activation of the ICT competence component. Table 4 presents the results of a study of the communicative component of ICT competence of teachers at the stage of EW formation, during which the leading types of behavior were identified: "dependent", "aggressive" or "competent".

Table 4

Results of evaluation of the instrumental and motivational component of ICT competence of teachers at the formative stage of the experiment, %

Group	Dependent	Aggressive	Competent
CG1	34	9	57
CG2	32	8	60
CG3	29	9	62
CG4	30	8	62
EG1	22	8	70
EG2	20	8	72
EG3	15	7	78
EG4	15	7	78

The dynamics of the assessment of the communicative component of ICT competence at the stage of EW formation showed that most teachers have a more pronounced component of the type of behavior. So, for experimental groups of teachers, this type of behavior is 77% for EG4, EG3 - 77%, EG2 - 71%, and EG1 - 69%. In turn, among the control groups, the component type of teacher behavior in communicative situations is more typical for CG4 and is 61%. The data obtained confirm the

professional orientation of teachers to partnership and interaction in communicative situations between the pedagogical community, which, of course, is one of the important professional skills for the further effective implementation of educational activities using IMP.

Let's pay attention to the almost unchanged indicators of aggressive behavior, which are 7-8% for control groups and 6-7% for experimental groups. First of all, this is due to the professional orientation of teachers to avoid manifestations of sharpness, irritation, categorical judgments, and negative evaluation of communication participants, events, and actions. A low level of aggressive behavior is a significant factor in the implementation of productive educational and professional activities of teachers. In general, the results of the study of the communicative component of ICT competence allow us to note an increase in the importance of partnership interaction between teachers of experimental and control groups using IMP, which is especially important in the conditions of professional activity in an open information and educational environment.

Table 5

Results of evaluation of the instrumental and motivational component of ICT competence of teachers

Group	Retrospective	Situational	Prospective
CG1	56	59	58
CG2	58	61	59
CG3	60	61	62
CG4	62	67	68
EG1	60	59	63
EG2	64	60	65
EG3	68	67	68
EG4	68	69	70

According to the data presented in the table, we can see similar levels of dynamics in various manifestations of reflexivity, and reflexive-evaluative components in the ICT competence of teachers, at the stages of formation of the SP and UP.

In general, the level of reflexivity of KG and EG increases throughout the entire training period, approaching a higher level of values of indicators. In turn, close and sometimes equal values (for example, the values for CG4 - 67% are equal to the data obtained, characteristic of EG3 - 67%) between the registered levels of reflexivity of teachers confirm minor differences between the levels of reflexivity of the compared experimental and control groups.

Diagnostics of the personal and creative component of ICT competence of teachers allowed us to determine the distribution of values on the scales of personal creativity among respondents at the stage of EW formation, presented in the table below.

Table 6

Results of the study of the types of reflection of the reflexive-evaluative component of ICT competence, %

Group	Personal creativity diagnostic scales for future tutors and teachers, %			
	Risk appetite	**Curiosity**	**Complexity**	**Imagination**
CG1	55	42	25	13
CG2	56	44	27	19
CG3	58	45	27	20
CG4	60	48	30	24
EG1	67	50	33	28
EG2	68	50	35	30
EG3	70	51	36	32
EG4	72	52	36	35

The maximum level of growth of indicators was recorded on the "risk appetite" scale in experimental groups (EG4 - 71%, in turn, CG4 - only 59%), which confirms the teachers' focus on goal-setting and their

focus on achieving goals with the help of IMP.

It is important to note the increase in the indicator on the "Imagination" scale of the diagnosis of personal creativity. However, a greater increase in this indicator was recorded among the respondents of the experimental groups (EG4 - 34%, EG3 - 31%, EG2 - 29%, EG1 - 27%). First of all, this is due to the use of an instrumental methodological platform in the conditions of informatization of teacher training. In addition, the use of IMP helps to increase the level of skills of independent activity of teachers, their focus on the development of an individual educational trajectory, the presence of variability in the means of achieving educational results, and the possibility of individual ways of solving professional tasks.

During the ascertaining stage of the experimental work, statistical processing of the obtained data was carried out using the multifunctional Fisher angle transformation criterion (φ* Fisher criterion). The criterion φ* allows us to determine whether one of the angles is statistically significantly superior to the other for a given sample size. The comparison between EG4 and CG4 demonstrated statistically significant differences (φ*=2.41, p=0.016), confirming the effectiveness of the proposed methodological platform.

The criterion φ* is aimed at comparing the percentages of two samples by the frequency of the studied effect and assessing the reliability of the differences between them to compare the formation of ICT competence of teachers of the control and experimental groups.

The following hypotheses were put forward as hypotheses:

H_0: the proportion of teachers with reproductive and productive levels of ICT competence in CS4 is not higher than in EG4.

H_1: The proportion of teachers demonstrating reproductive and productive levels of ICT competencies is higher in CG4 than in EG4.

It should be noted that the constructive level of formation of ICT competence of teachers was recorded in both experimental and control groups. The CG4 control group demonstrated a constructive level of ICT competence, which was characteristic of the following components of ICT competence: instrumental-activity (5.0%), reflexive-evaluative (10.2%), and personal-creative (10.2%).

During the formative stage of the experimental work, statistical data processing was also carried out using a multifunctional Fisher angle transformation test (φ* Fisher criterion).

Conclusions

In conclusion, the article summarizes the results of the study, as well as presents the main conclusions on the use of the instrumental and methodological platform. Teachers in the experimental group demonstrated significantly higher levels of ICT competence, communication skills, and professional motivation than teachers in the control group. Statistical analysis confirmed that these differences were significant, indicating that the proposed platform positively influenced teachers' professional competency development.

1. An approach to informatization of teacher training for the development of ICT competence is proposed based on the use of an instrumental and methodological platform for mastering the disciplines of the computer science and geography cycle in the information and educational environment. This platform provides teachers with the opportunity to use various information and communication technologies (ICT) in the preparation and conduct of computer science and geography lessons. It includes programs, tools, and resources that help teachers create interactive lessons, develop and review assignments, and evaluate and monitor student performance. The use of such a platform allows teachers to effectively use ICT tools, such as interactive whiteboards, software for creating and editing multimedia materials, computer programs for analyzing geographical data, etc. The use of an instrumental and methodological platform allows teachers to effectively organize work in the classroom, share materials and resources with students, as well as provide feedback and support in the learning process. This not only improves the quality of education but also helps teachers to use their time and resources more effectively.

2. The article proves that the instrumental and methodological platform is an effective means of developing the ICT competence of teachers in information education, taking into account their personal and professional development when using its methodological functions and didactic properties: Interactivity is the possibility of interaction and exchange of information between teachers. This allows you to create an active and dynamic educational environment where each participant can demonstrate their knowledge and

skills; Multimedia – the use of various multimedia materials, such as video, audio, and images, for teaching and illustrating concepts and concepts. Multimedia elements will make lessons more visual and memorable; publicity – the possibility of publishing and sharing materials, assignments, and work results between teachers and students. This allows you to create cooperation and interaction between different participants of the educational process; Non-linearity - the ability to choose the order of studying the material and performing tasks by students, depending on their individual needs and interests. This contributes to taking into account the individual characteristics of each student and adapting the educational process to his needs; Integrativity – the ability to integrate various disciplines and courses, which allows you to create comprehensive and related educational programs. This helps students to see the connections between different subject areas and apply their knowledge in different situations.

3. A model of the formation of ICT competence of teachers in the conditions of informatization has been developed and substantiated. Formation of ICT competence of teachers is an important task in the conditions of modernization (informatization) of education. The model developed for this purpose should be justified taking into account modern requirements and trends in the field of information and communication technologies. One of the main components of the model of formation of ICT competence of teachers is training. This can be both formal education (courses, training, master classes) and informal training (self-education, exchange of experience with colleagues). Training should include not only the development of specific ICT skills but also the development of pedagogical competencies that allow the effective use of information technology in the educational process. Support from the school or educational institution administration also plays an important role in the model. The administration should provide access to the necessary ICT resources and infrastructure, as well as create conditions for the exchange of experience and cooperation between teachers. In addition, the administration should support the initiatives of teachers aimed at introducing innovative ICT solutions. Another component of the model is the constant self-development of the teacher. Information technology is constantly evolving, and the teacher should be ready to be aware of the latest trends and update their knowledge and skills. It is also important to develop a teacher's conscious attitude to ICT competence and the ability to self-assess so that he can systematically analyze his strengths and weaknesses and work on their improvement. Finally, the model should take into account the context and specifics of the educational institution. Each school or educational institution has its characteristics, and the introduction of ICT should be adapted to these characteristics. The model should contain flexibility and the ability to adapt to changes that may occur in the organization. Thus, the model of formation of ICT competence of teachers should be justified based on modern requirements and trends, taking into account the educational context, and contain elements of training, support, self-development, and adaptation.

4. A platform has been developed and implemented to provide methodological support for the formation of ICT competence of teachers in the context of the implementation of the proposed approach to informatization of its formation, including work programs of disciplines, electronic educational and methodological support for their implementation, a set of educational and methodological materials that provide all types of educational activities. This is a significant step in the development of informatization of education. The presented methodological platform is a comprehensive solution that includes several components. Working programs of disciplines help to structure the educational process and determine the main goals and objectives of teacher training. They are an important tool for planning and evaluating the learning process. Electronic educational and methodological support allows teachers to access digital resources, materials, and tools for teaching. It provides teachers with the opportunity to use modern technologies and techniques in their work, making the learning process more interactive and effective. The set of teaching materials provided on the platform is a valuable source material for teachers. These materials include textbooks, lesson summaries, assignments, and examples of work that help teachers develop lessons, conduct practical classes, and evaluate students' academic achievements. The platform offers comprehensive support to teachers in the formation of ICT competence. It not only provides the necessary educational content but also creates conditions for the development of key skills and abilities of teachers in the field of information technology. By using this platform, teachers will be able to become more confident and competent in using ICT in their teaching practice. This, in turn, will help them teach more effectively, create interesting and interactive lessons, and also improve the educational process as a whole.

5. The effectiveness of the formation of ICT competence in the implementation of the proposed

approach to informatization of education, taking into account the developed methodological support, is proved. Significant positive changes in the level of formation of ICT competence of teachers in experimental groups allow us to confirm the hypothesis and solve research tasks. These results mean that the proposed approach to informatization of education and the developed methodological support have a significant impact on the formation of ICT competence of teachers. This may be especially important in the modern information society, where the use of information and communication technologies is becoming increasingly necessary in the educational environment. Research is a valuable research contribution and can serve as a basis for further development and improvement of approaches to the formation of ICT competence of teachers. This also confirms the importance and usefulness of the methodological support that was developed during the research process.

Conflict of Interest Statement

The authors declare no potential conflicts of interest regarding the research, authorship,or publication of this article.

Author Contributions

Zh.E. Zulpykhar, N.T. Shyndaliyev, R.Z. Zhilmagambetova, and D.E. Kapanova contributed equally to this work. All authors were involved in the conceptualization, methodology, data collection, analysis, and interpretation of the results. All authors participated in writing, reviewing, and editing the manuscript and approved the final version for publication.

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